Technology: Optoelectronics

First 40 Gb/s modules using HBTs

Yokogawa Electric Corp (Tokyo, Japan) has launched the world's first series of modules for 40 Gb/s data rates based on HBTs:

- a driver for lithium niobate modulators (output: at least 5 V_{pp}; gain: 23 dB);
- a driver for electro-absorption modulators (output: at least 4 V_{pp}; gain: 15 dB);
- a flip-flop logic circuit (which retimes 40 Gb/s signals);
- a 1-to-2 demultiplexer;
- a 2-to-1 multiplexer.

HBTs boast marginal jitter and high output power compared with HEMT or SiGe bipolar transistors.

Yokogawa will also develop 4-to-1 mux and 1-to-4 demux modules for 40 Gb/s. Also, in cooperation with **Ando Electric Co Ltd** (Kawasaki, Japan), it will develop measuring instruments for optical transmission systems that incorporate these modules.

L- and C-band InGaAs photodiode with < 0.5% reflectance

OSI Fibercomm Inc (Hawthorne, CA, USA) has developed a broadband anti-reflection (AR) coated InGaAs/InP photodiode, creating an ultra-low reflectance in the 1520-1620 nm transmission window. It demonstrates less than 0.5% typical optical reflectance over the wide L- and C-band wavelength range, achieved by depositing a proprietary multi-layered, dielectric AR coatings directly onto the surface of the photodiode to counter the adverse effect of back reflection in laser modules.

OSI Fibercomm also recently started sampling its 10 Gb/s InGaAs photodetector chip.

Acelo launches with GaAs pHEMTs for 40 Gb/s

New start-up **Acelo Semiconductor Inc** (Oxnard, CA, USA;Tel: +1-805-278-3200) has been launched to design, develop, make and market GaAs pHEMT-based ICs for 10 and 40 Gb/s fibre-optic networks (with an exclusive license for pHEMT technology from Rockwell Scientific). CEO John Hong spent 13 years with Rockwell (most recently as Director of Electronics), while investors include Rockwell Scientific, Cisco and Parakletos@Ventures.

Acelo's products include OC192 and OC768 analog chip-sets (available in early 2002) made at its 4" GaAs/InP fab.

"*As single-channel data rates increase from 10 Gb/s to 40 Gb/s, it presents a significant challenge to the chip technology, especially for difficult functions such as modulator drivers and trans-impedance amplifiers*," said Rockwell Scientific president & CEO Derek Cheung. "With its in-house pHEMT fab technology and innovative design expertise, Acelo is the only company that offers a solution to such requirements while meeting the performance and reliability criteria."

Hong says "Having all design and fabrication in-house... allows us to best apply a customized approach and deliver immediate solutions."

Key considerations for the analog chips in SONET transponders are switching speed, power dissipation and breakdown voltage.The GaAs pHEMT technology provides the necessary performance elements required for OC192 and OC768 analog applications while offering a maturity level that directly addresses manufacturing and reliability concerns.

Five of Acelo's seven products are sampling at both the OC192 and OC768 data rates:
- OC192 Laser Driver - low power dissipation of 800-900 mW at full drive current current (for greater reliability and a small packaging size of 1.0 x 1.1 mm) and high gain/low noise (for higher sensitivity);
- OC192 Modulator Driver - high output voltage swing is 7.5 V_{pp} (with 26 dB gain) at 1.4 W chip dissipation;
- OC192 High Gain TIA - High transimpedance gain (TZ) of 10 kΩ with limiting output;
- OC768 Modulator Driver - high output voltage swing is 8 V_{pp} (with 17dB gain) at 800 mW wideband operation ranges from 100 kHz-50 GHz (3 dB pts). Currently the only single-chip solution capable of driving lithium niobate modulators;
- OC768 TIA - high TZ gain of 400-800 Ω.

For broadband wireless, Acelo also offers power and low-noise amplifiers for the point-to-point and point-to-multipoint distribution systems operating at 30+ GHz.

Acelo is also developing mixed-signal ICs for OC768 to complete its chip-set offering for OC768 transponders (available in early 2002).

33.4%-efficient GaInP/GaAs-GaSb solar cells

TECSTAR Inc (City Of Industry, CA, USA) and gallium antimonide (GaSb) infrared photovoltaic cell maker **JX Crystals Inc** (Issaquah, WA, USA) have been working together on an extension to a Phase II Ballistic Missile Defense Organization (BMDO) Small Business Innovation Research (SBIR) contract to build a prototype module to demonstrate the high efficiency achieved by mechanically stacking space solar cells.

In Phase I, in was shown that the efficiency from JX Crystal's GaSb IR booster cell (7%) - mechanically-stacked and voltage-matched with TECSTAR's IR-transparent 24%-efficient dual-junction InGaP/GaAs front cell - is intrinsically higher than the boost efficiency for a germanium cell (3%) in a series-connected monolithic dual-junction/Ge cell. At 15-suns (AMO), the full stack was 31% efficient.

Recent tests have now confirmed 33.4% cell efficiency at 15 AMO: 27% from the InGaP/GaAs cell and 6.4% from the GaSb.

"With the prismatic cover, the overall cell efficiency will be over 35%," says Project Lead Dr Charlie Chu. "TECSTAR and JX Crystals anticipates our next cell efficiency to reach over 40% within the next few months."

* After attaining a solar cell efficiency of 31.1% with mechanically stacked tandem cells of GaAs/GaSb, Fraunhofer ISE (Freiburg, Germany) has recently achieved a record efficiency of 31% for a monolithically stacked InGaAs/InGaP tandem concentrator solar cell.

With further development, Fraunhofer ISE expects that efficiencies exceeding 35% are achievable.

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